

# Insect predators of the apple leaf miner *Lyonetia clerkella* Linn. (Lepidoptera: Lyonetiidae) in Kashmir

<sup>1</sup>Sumi Ulah Rather and <sup>2</sup>Abdul A. Buhroo

<sup>1,2</sup>Section of Entomology, Postgraduate Department of Zoology, University of Kashmir, Hazratbal, Srinagar-190006 (India)

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## ABSTRACT

In the present study, three species of coccinellid beetles, that is, *Oenopia conglobata*, *Harmonia eucharis* and *Priscibrumus uropygialis* and one species of wood ant (*Formica* sp.) were found as the natural enemies of *Lyonetia clerkella*. The *O. conglobata* and *H. eucharis* are the most predominant insect predators whose larvae voraciously devour the caterpillars and pupae of this leaf miner pest. Adult *P. uropygialis* and wood ant (*Formica* sp.) were observed to feed on the caterpillars of the apple leaf miner. The insect predators associated with *L. clerkella* reached to their maximum densities at the same time when the populations of this pest were at the peak, during the final week of May (2016). The rate of predation maximizes in May and June (2016) when the population of host is relatively higher than the other months. However, beyond the fourth week of June (2016), the frequency of such incidences decreases because of reduction in the number of egg laying female moths.

## 1. Introduction

The apple leaf miner, *Lyonetia clerkella* Linn. (Lepidoptera: Lyonetiidae) is a serious pest of apple orchards in Kashmir valley. It produces five generations per year in Kashmir under natural conditions (Rather and Buhroo, 2015). In the valley, the primary host of this leaf miner is apple (*Malus domestica* Borkh.). However, this micro lepidopteron pest also damages the other temperate fruit trees including quince (*Cydonia oblonga*), peach (*Prunus persica*), plum (*P. domestica*), cherry (*P. avium*), apricot (*P. armeniaca*), and pear (*Pyrus communis*) in many parts of the world such as Japan, South Korea, Taiwan, China, north-western Siberia, India, Europe, Turkey and Madagascar (Inoue *et al.*, 1982 and Agata *et al.*, 2007). It's a major insect pest in commercial peach orchards of Japan where it causes heavy defoliation prior to harvest (Naruse, 1978a; Naruse and Hirano, 1990).

Female moths of *L. clerkella* deposit their eggs singly into the underside of leaves (Adachi, 2002). Hatched larvae penetrate into the mesophyll and form spiral mines. The mine gets serpentine or linear form with the growth of the underlying caterpillar. The three pairs of thoracic blackish legs differentiate the 3<sup>rd</sup> instar larvae from the 1<sup>st</sup> and 2<sup>nd</sup> instars and these legs can easily be seen through the outer coverings of a leaf. The fully grown 3<sup>rd</sup> instar larvae emerge from their respective mines and pupate in silken cocoons under the leaves or on the other plant structures.

The biology of *L. clerkella* has intensively been studied since the 1970's (Fujiwara *et al.*, 1978; Naruse, 1981; Naruse and Hirano, 1990; Rather and Buhroo, 2015), damage pattern (Naruse, 1978b), sex pheromone (Sato *et al.*, 1986; Sonnet *et al.*, 1987), parasitoid association (Adachi, 1998; Rather *et al.*, 2017). In spite of this, little attention has been given to the insect predators associated with this leaf miner. Therefore, the primary objective of our study was to identify the different predatory insect species of *L. clerkella* in the apple orchards of Kashmir. Understanding the role of predation may be beneficial

in developing a management for this pest through such biological control agents.

## 2. Material and Methods

The research was conducted from April to September (2016) in the field located within the campus of Kashmir University, Srinagar (34°07.871'N 74° 50.028' E, Elevation 5230 ft.). The study area comprises about 2 hectares of land with several species of fruit trees including quince (*Cydonia oblonga*), peach (*Prunus persica*), plum (*P. domestica*), apricot (*P. armeniaca*), and pear (*Pyrus communis*). However, apple is the most predominant one. These trees were surveyed continuously after every 3 or 4 day intervals as per the method adopted by Adachi (2002). Insect predators attacking the caterpillars and pupae of *L. clerkella* were collected from the sampled host trees (*M. domestica*). The live specimens of these predators were placed in the insect boxes with infested apple leaves carrying both larvae and pupae of the apple leaf miner pests. Thereafter, the number of larvae or pupae of host devoured by a specific insect predator was noted. Predation events in the field as well as in the laboratory were photographed by using Canon EOS 1200-D camera attached with Reynox super macro 250-D lens on a 75-250 mm zoom lens.

## 3. Results and discussion

The results of the present study revealed three coccinellid beetles such as *Oenopia conglobata*, *Harmonia eucharis*, *Priscibrumus uropygialis* and wood ant (*Formica* sp.) as the natural predators associated with *L. clerkella*. Among them, coccinellid beetles such as *O. conglobata* and *H. eucharis* were found predominant. The larvae of these insect predators devour the caterpillars and pupae of this leaf miner pest (Figs. 1 & 2). The larvae of this lepidopteron moth were also observed to be consumed by the adults of another coccinellid beetle, *P. uropygialis* and wood ant (*Formica* sp.) (Figs. 3 & 4). These predators reached to their maximum densities in the fourth week of May (2016) at the same time when the populations of *L. clerkella* were at the peak. Meanwhile, the percent infestation

intensity was also found to decline which indicates that these natural biological agents might have a role in controlling the apple leaf miner pests. Insect predators of pyralid moth, *Omphalocera munroei* were also reported to maximize in number during the high population densities of this pest (Damman, 1987).

The events of predation were observed to occur frequently in the months of May and June (2016) the time when the population densities of *L. clerkella* are at the peak. However, the frequency of such incidences decreases with the reduction in the number of moths, from the fourth week of June onwards. During every survey, from the 1st week of May to the last week of the following month (June), the above mentioned insect predators were found engaged in devouring the larvae and or pupae of the apple leafminer pests on 3 (25%) out of every 12 host plants. While the beetles and their larvae were seen

feeding on the larvae and pupae of the apple leafminer insects, the numbers of them involved in this process on a host tree was found very low as compared to wood ants. These ants (*Formica* sp.) were observed to attack the host larvae and pupae in relatively large numbers. Of an average, 10 such ants were found to attack on a single host larva and only about 3 of them succeeded in consuming the later; while as a single larva or adult of the *Coccinella* beetles were found to do so. Furthermore, the findings of the present study indicate that the apple leaf miner pests can be managed through the above mentioned coccinellid beetles and wood ant (*Formica* sp.). Many studies also show that the natural enemies like insect predators play a key role in the management of various pests including the leaf miners (Chambers *et al.*, 1993; Desneux *et al.*, 2006; Bosco *et al.*, 2008; Fathi and Nouri-Ganbalani, 2010; Weintraub *et al.*, 2011).

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Fig. 1: The *Oenopia conglobata* larva devouring the caterpillar of *L. clerkella*



Fig. 2: The *Harmonia eucharis* larva feeding on the pupa of *L. clerkella*



Fig. 3: *Priscibrumus uropygialis* feeding on the larva of *L. clerkella*



Fig. 4: Wood ant (*Formica* sp.) feeding on the larva of *L. clerkella*